Attorney Docket No. 3827 P 009 PATENT

2811

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re U.S. Patent Application of:	)
James Andrew Breach and Robert Brian Turner	) Examiner:
	)
Application No. 10/025,006	) Art Unit: 2811
Confirmation No. 3634	)
Filed: December 19, 2001	)
	)
For: Ion Mobility Spectrometer	)

TRANSMITTAL OF CERTIFIED COPY OF PRIORITY DOCUMENT

Commissioner for Patents
Washington, D.C. 20231

Enclosed is the certified copy of the foreign application from which priority is claimed for this case.

Country:	Great Britain
Application No.:	9914552.6
Filing Date:	June 23, 1999

Respectfully submitted,

Date: 18 Feb. 2003 By: _____

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CERTIFICATE OF MAILING (37 C.F.R. § 1.8a)
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Gillian Gardner

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I also certify that the attached copy of the request for grant of a Patent (Form 1/77) bears an amendment, effected by this office, following a request by the applicant and agreed to by the Comptroller-General.

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Dated 10 October 2002

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23 JUN 99 P01/7700 0.00-9914552.6

1/77

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The Patent Office

Cardiff Road
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23 JUN 1999

[SUPERSEEDED]

1. Your reference CP152

2. Patent application number *(The Patent Office will fill in this part)* **9914552.6**

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

Graseby Dynamics Limited
Park Avenue
Bushey
Watford
Herts
WD2 2BW

Patents ADP number *(if you know it)* 4779100200 2MB

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention Ion Mobility Spectrometers.

5. Name of your agent *(if you have one)*

~~Michael Wayget~~

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

~~43 Fen Rd~~
~~Milton~~
~~Cambridge~~
~~CB4 6AB~~

Kilburn & Strode
20 Red Lion Street.
LONDON
~~55877900~~
WC1R 4PJ

Patents ADP number *(if you know it)*

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Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*
—		

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

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b) there is an inventor who is not named as an applicant, or
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Description	5
Claim(s)	
Abstract	
Drawing(s)	1 + 1

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Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature Date

12. Name and daytime telephone number of person to contact in the United Kingdom

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Graseby Dynamics Limited

Ion Mobility Spectrometers

The present invention relates to ion mobility spectrometers used for gas and vapour detection, and more particularly to ion mobility spectrometer systems in which the system is "doped", or has added to it, a low concentration of a trace reagent vapour or vapours (the "dopant") to improve the sensitivity of the system to gases or vapours of interest, or to improve the rejection of interfering materials, i.e. those which may otherwise give rise to a response interfering with detection of gases and vapours of interest.

The use of dopants in IMS systems is well known and the principles involved have been described in the literature, for example, in the introduction to European Patent Application No 219,602 A2.

Dopant sources commonly consist of a sealed container with a permeation capability containing the chosen dopant material, with the container incorporated in the circulating system of the IMS detector, comprising the ion mobility cell, means such as a sieve pack for drying and cleaning the recirculating gases in the system, the dopant source, and a pump, into which samples of gases or vapours of interest, usually air-borne, are drawn for analysis.

In accordance with one aspect, the present invention consists in an ion mobility spectrometer system in which the dopant material is physically combined with molecular

sieve material, whereby the need for a physically separate dopant source for the system is obviated.

In accordance with another aspect, the invention consists in a combined dopant source and molecular sieve, for use, for example, with an ion mobility spectrometer.

In accordance with a still further aspect the invention consists in a method of physically or chemically combining a molecular sieve material with a dopant material to provide a combined dopant and molecular sieve for use with an ion mobility spectrometer.

The invention provides a number of advantages over current practice in which separate dopant sources and molecular sieve packs are employed.

For example, in hand-held or body-worn IMS equipment, space within the equipment housing is at a premium, and use of a combined dopant source/molecular sieve reduces the space requirement of the circulating system.

Additionally, and especially in small instruments, there is a need to regularly change the molecular sieve. By providing a combined sieve and dopant source in a single pack, a dopant change, desirable for maintaining a consistent level of dopant within the circulating system, is provided at the same time by a single action.

Current practice requires dopant sources associated with IMS circulating systems to be heated when the instrument is operated at low temperatures. With a combined sieve and dopant source it has been found possible to maintain dopant levels within the circulating system at low

temperatures without the need for heating, further simplifying, and reducing the space and power requirements of, the instrument.

It has been found that combination of the dopant and the sieve material provides the required level of sensitisation of the IMS instrument to samples of interest and/or rejection of interferents.

Use of the combined dopant and sieve material within the circulating system of an IMS instrument, has also been found to improve dopant capability over a range of ambient temperatures from -30 C to +50 C.

Figure 1 of the accompanying drawings shows a simplified block diagram of a conventional ion mobility spectrometer employing a closed-loop recirculatory system, comprising a pump 10, an IMS cell 12, a pair of molecular sieve packs 14,16 for drying the carrier gas, most usually air, in the recirculatory system, and a dopant source 18, for providing the required level of dopant for sensitivity enhancement, and/or interferent rejection.

In operation ambient air, which may contain gas or vapour of interest, is drawn into the circulatory system, by way of an inlet system, not here shown, and passed through the IMS cell 12 which is able, in association with conventional electronic instrumentation not here shown, to provide an electrical output representative of the presence and/or the quantity of a gas or vapour of interest in the ambient air sampled.

Figure 2 shows the same instrument as is shown in

Figure 1, only with the original pair of molecular sieve packs and the dopant source replaced with a pair of combined dopant molecular sieve packs 20, 22.

The required combination of mixed sieve and dopant material may be produced by placing the dried molecular sieve material in a sealed vessel with the correct mass of doping material, and heating the mixture to 50 C for some twelve hours.

The combination of the materials may be achieved at higher or lower temperatures, given an appropriate modification of the time to permit combination.

The combined material may also be made by passing a dry inert gas stream containing the dopant material at a fixed level over the molecular sieve material and allowing the molecular sieve material to absorb the dopant material.

The mechanism by which dopant material is adsorbed on to the molecular sieve is a reversible physical adsorbtion, meaning that with a given mass of material adsorbed on to the sieve at a given temperature the partial pressure of the adsorbed dopant material over the sieve is constant.

In an IMS system where there is carrier gas flow over the combined dopant/sieve material, and leakage of the carrier from the system, the adsorbed dopant material will be removed from the sieve material.

In a closed recirculating system, adsorbed material will be released into the carrier gas, but subsequently replaced in the sieve material, thereby maintaining a continuing constant level of dopant within the system.

By way of example, a combination of ammonium carbamate dopant, and a 13X pore size molecular sieve material, combined in the proportion of between 0.1% to 5% by weight of dopant to sieve material, was used with an ion mobility spectrometer such as shown in Figure 2 of the drawings.

The spectral response of the three target compounds chosen for study : DMMP (0,0-Dimethyl Methane Phosphonate); TEP (Triethyl Phosphate); and DPM (Dipropylene Glycol Mono Methyl Ether); using the specified combined dopant/molecular sieve material, remained sensibly constant over a temperature range of -30 C to +50 C.

It will be apparent that other doping compounds may be employed, chosen to provide a dopant level in a required range.

Other absorbant materials may also be employed in the manufacture of combined dopant/sieve materials.

It has been found that the system described is longer lasting than a comparable standard permeation source and sieve system.

Although the described example employs a combined dopant/sieve as the only dopant source within the system, the combined dopant/sieve may be used in an instrument system in addition to a standard dopant source, in order to provide multiple doping of the system, or to provide additional doping, for example to support the standard permeation dopant source at low temperatures.

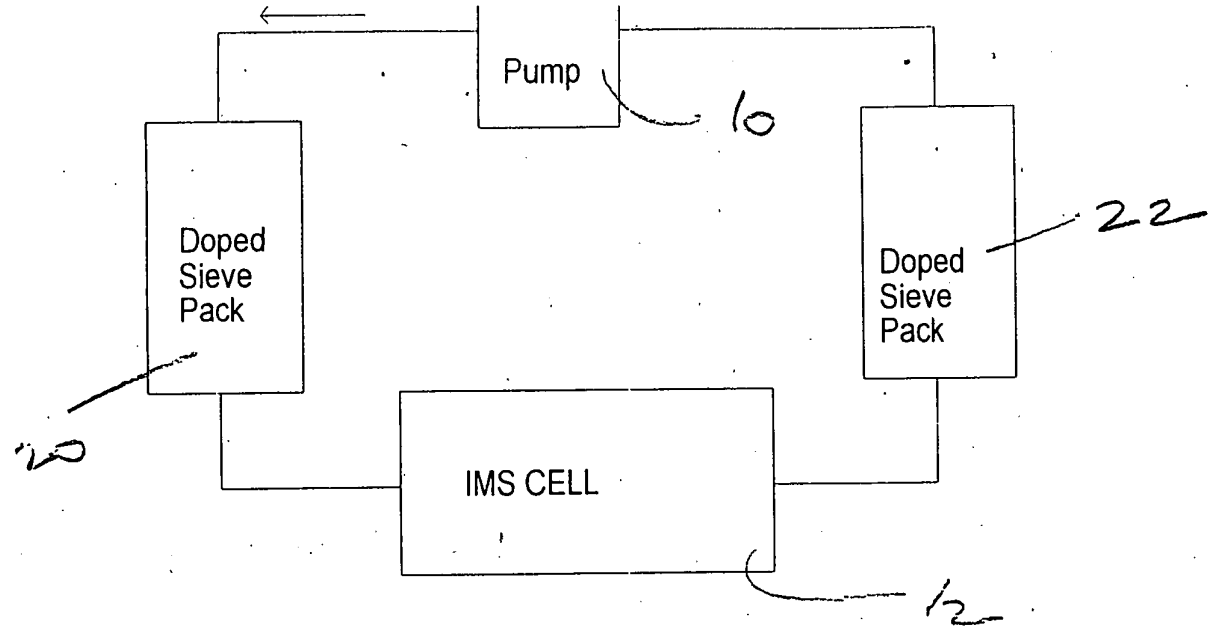
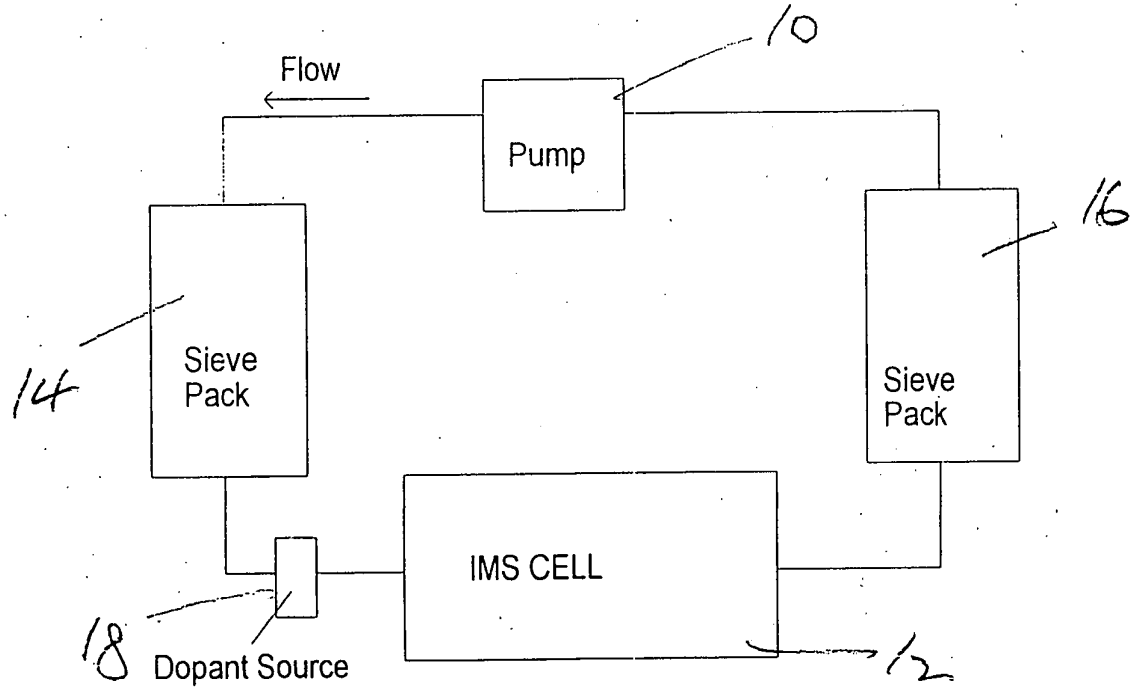

Pump
10
Doped
Sieve
Pack
20
Doped
Sieve
Pack
22
IMS CELL
12

FIG 2


10
Flow
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16
14
Sieve
Pack
Sieve
Pack
IMS CELL
18
Dopant Source
12

FIG 1